

NASA TECH BRIEF



NASA Tech Briefs are issued to summarize specific innovations derived from the U.S. space program, to encourage their commercial application. Copies are available to the public at 15 cents each from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

Computer Program Uses Characteristics Method for Free-Jet Investigation

The problem:

The flow of rocket exhaust gases from highly under-expanded nozzles operating in near-vacuum conditions results in large billowing jet plumes. Interference of this plume with a vehicle, other plumes, or adjacent objects creates problems in the structural design and proper functioning of the vehicle and in the performance of its mission.

The solution:

A computer program to compute the free-jet boundary contours and other flow properties within the nozzle exhaust plume.

How it's done:

The calculation of free-jet boundaries by the method of characteristics makes use of three-dimensional irrotational equations of flow. The characteristic net describing the flow field, a lattice point-type structure with no iteration performed, is machine computed in a point-to-point calculation procedure.

Computations begin with a set of given conditions on the leading characteristic line plus the conditions for a series of two-dimensional expansion rays originating at the nozzle lip. The program permits calculations to high ratios of nozzle exit pressure to ambient pressure and extends the calculations to large distances downstream of the nozzle exit.

Notes:

1. This program is written in Fortran IV for use on the IBM 7094 computer.
2. Inquiries concerning this program may be made to:
COSMIC
Computer Center
University of Georgia
Athens, Georgia 30601
Reference: B67-10490

Patent status:

No patent action is contemplated by NASA.

Source: Charlotte B. Craidon
Langley Research Center
(LAR-10117)

Category 06